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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/762,555	04/10/2001	Lothrop Mittenthal	TET-1668/980	6718

7590

05/18/2005

Robert A Muha
Kirkpatrick & Lockhart
Henry W Oliver Building
535 Smithfield Street
Pittsburgh, PA 15222-2312

EXAMINER

LAFORGIA, CHRISTIAN A

ART UNIT

PAPER NUMBER

2131

DATE MAILED: 05/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/762,555

Applicant(s)

MITTENTHAL, LOTHROP

Examiner

Christian La Forgia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 3, 5 and 6 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4 and 7-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 17 March 2005 has been entered.
2. Claims 1, 2, 4, and 7-22 have been presented for examination.
3. Claims 3, 5, and 6 have been cancelled as per Applicant's request.

Response to Arguments

4. Applicant's arguments filed 17 March 2005 have been fully considered but they are not persuasive.
5. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).
6. In response to Applicant's arguments that Mittenthal does not disclose maximizing the nonlinearity of block substitution tables, the Examiner disagrees. Mittenthal defines nonlinearity as the mappings of clear text to encrypted text and vice versa in column 12, lines 1-23. One goal of such a technique is to provide for an encryption scheme so that patterns will not persist or emerge to allow for cryptanalysis of the pattern, as stated by Mittenthal in column 6, lines 49-67. One of ordinary skill in the art would recognize that maximizing the nonlinearity of a

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substitution table would increase the difficulty of the cryptanalysis of the encrypted text, thereby providing for a more secure communication.

7. The Examiner disagrees with the Applicant's argument that no evidence of unexpected results need to be submitted as there has been a long felt need for maximizing the nonlinearity of block substitutions. The Attorney is reminded that argument or allegations are not evidence unless it is an admission, in which case, an Examiner may use the admission in making a rejection. The arguments and allegations of counsel cannot take the place of evidence in the record. See MPEP § 2144.09; see *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965); see *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997).

8. Additionally the Applicant has stated there has been a long-felt-need for maximal linearity in block substitutions. Objective evidence or secondary considerations such as unexpected results, commercial success, long-felt need, failure of others, copying by others, licensing, and skepticism of experts are relevant to the issue of obviousness and must be considered in every case in which they are present. When evidence of any of these secondary considerations is submitted, the examiner must evaluate the evidence. The weight to be accorded to the evidence depends on the individual factual circumstances of each case. See MPEP § 2141; see *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); see *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 USPQ 81 (Fed. Cir. 1986), *cert. denied*, 480 U.S. 947 (1987).

9. The Applicant has failed to supply any evidence for secondary considerations, and have not been considered as persuasive arguments.

10. See further rejections that follow.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. The term "maximal" in claims 1, 2, 4, and 7-22 is a relative term which renders the claim indefinite. The term "maximal" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. See MPEP § 2173.05(b). See *Ex parte Caldwell*, 1906 C.D. 58 (Comm'r Pat. 1906). See *Ex parte Anderson*, 21 USPQ2d 1241 (Bd. Pat. App. & Inter. 1991).

Claim Rejections

13. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

14. As per claim 1, Luyster teaches method of deterministically generating maximal nonlinear block substitution tables for a predetermined block size, comprising:

selecting a first generating function (Figures 1 [blocks k1, k2], 2 [block key1, key 2], 5 [blocks 92, 100g], 11; column 38, lines 24-36; column 51, lines 19-67);

selecting a second generating function (Figures 5 [blocks 94, 100h], 11; column 38, lines 24-36; column 51, lines 19-67);

selecting first and second sets of complete linearly independent numbers (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28);

calculating first and second linear functions from the generating functions and the sets of linearly independent numbers (Figure 1 [blocks 16, 18], 3 [blocks 84, 86], 6 [blocks 144, 146], 7 [blocks 184, 186], 9 [block 226, 228], 14 [blocks 342, 344]; column 22, lines 6-25; column 42, lines 28-38; column 57, lines 20-60).

15. Luyster discloses combining first and second linear functions to produce a nonlinear block substitution table, or s-box, as evident by at least the Abstract.

16. Luyster discloses the claimed invention except for the use of linear orthomorphisms, thereby failing to create maximal nonlinear block substitution tables by combining the linear orthomorphisms.

17. Mittenthal discloses using nonlinear orthomorphisms to create maximal nonlinear block substitution tables (column 2, lines 39-60).

18. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use linear orthomorphic functions to generate a nonlinear block substitution table as taught by Mittenthal, since Mittenthal discloses at column 2, lines 39-43 that such a modification would make cryptanalysis more difficult while still using relatively simple hardware. Furthermore, Mittenthal discloses in column 19, lines 26-32 that generating nonlinear orthomorphisms involves routine skill in the art. Mittenthal defines nonlinearity as the mappings of clear text to encrypted text and vice versa in column 12, lines 1-23. One goal of such a technique is to provide for an encryption scheme so that patterns will not persist or emerge to allow for cryptanalysis of the pattern, as stated by Mittenthal in column 6, lines 49-67. One of ordinary skill in the art would recognize that maximizing the nonlinearity of a substitution table

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would increase the difficulty of the cryptanalysis of the encrypted text, thereby providing for a more secure communication.

19. Chapter 2144.05 of the MPEP states that optimizing an algorithm will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such optimization is critical. See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Therefore, deterministically generating maximal nonlinear block substitution tables is not patentable as there have been disclosures of using linear orthomorphisms to create nonlinear block substitution tables. In addition there has been no evidence provided that such an optimization is critical or produces unexpected results. See also MPEP § 2131.03.

20. Regarding claim 2, Luyster teaches wherein selecting a first generating function includes selecting a first primitive generating function (Figure 6; column 37, lines 55 to column 38, lines 23).

21. Regarding claim 3, Luyster teaches wherein selecting a first generating function includes selecting a first nonprimitive generating function (Figure 6; column 37, lines 28-45).

22. Regarding claim 4, Luyster teaches wherein selecting a second generating function includes selecting a second primitive generating function (Figure 6; column 37, lines 55 to column 38, lines 23).

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23. Regarding claim 5, Luyster teaches wherein selecting a second generating function includes selecting a second nonprimitive generating function (Figure 6; column 37, lines 28-45).

24. With regards to claim 6, Luyster teaches wherein selecting a second non-primitive generating function includes selecting a second non-primitive generating function having a cycle pattern that is identical to a cycle pattern of the first generating function (column 37, lines 18-45).

25. Regarding claim 7, Luyster teaches wherein calculating first and second linear orthomorphisms includes calculating first and second maximal linear orthomorphisms from the generating functions and the sets of linearly independent numbers (Figure 1 [blocks 16, 18], 3 [blocks 84, 86], 6 [blocks 144, 146], 7 [blocks 184, 186], 9 [block 226, 228], 14 [blocks 342, 344]; column 22, lines 6-25; column 42, lines 28-38; column 57, lines 20-60).

26. Regarding claim 8, Luyster teaches further comprising rotating the second linear orthomorphism (column 37, lines 37-45). It would have been obvious to one of ordinary skill in the art at the time the invention was made to rotate the second linear orthomorphism. One would be motivated to adopt this technique because it is fast, simple, and add more security.

27. With regards to claim 9, Luyster teaches wherein rotating the second linear orthomorphism includes rotating corresponding cycles of the second linear orthomorphism (column 37, lines 37-45).

28. Regarding claim 10, Luyster teaches wherein selecting a second generating function includes selecting a second generating function which is a complement of the first generating function (column 38, lines 5-36; column 39, line 60 to column 40, lines 28).

29. Regarding claim 11, Luyster teaches wherein selecting a second generating function includes selecting a second generating function which is any generating function that is not identical to the first generating function and has a cycle structure which matches a cycle structure of the first generating function (column 38, lines 5-36; column 39, line 60 to column 40, lines 28).

30. Regarding claim 12, Luyster teaches wherein selecting first and second sets of linearly independent numbers includes selecting a second set of linearly independent numbers that is identical to the first set of linearly independent numbers (column 39, lines 17-28).

31. Regarding claim 13, Luyster teaches wherein selecting first and second sets of linearly independent numbers includes selecting a second set of linearly independent numbers that is not identical to the first set of linearly independent numbers (column 39, lines 17-28).

32. Regarding claim 14, Luyster teaches further comprising determining whether all cycles of the first and second linear orthomorphisms are self-contained (column 23, line 50 to column 24, line 27).

33. With regards to claim 15, Luyster teaches further comprising selecting pairs of cycles from the first and second linear orthomorphisms to produce a mapping for which $N(x,y) \neq 0$ for all pairs of numbers from different cycles (Figure 12; column 33, line 37 to column 34, line 36).

34. As per claim 16, Luyster teaches a computer-implemented method for deterministically generating maximal nonlinear block substitution tables from binary data, comprising:

selecting a first set of a plurality of complete linearly independent numbers from the binary data (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28);

selecting a second set of a plurality of complete linearly independent numbers from the binary data (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28);

generating plurality of linear functions using first and second recursive generating function and the first and second sets of linearly independent numbers (Figure 1 [blocks 16, 18], 3 [blocks 84, 86], 6 [blocks 144, 146], 7 [blocks 184, 186], 9 [block 226, 228], 14 [blocks 342, 344]; column 22, lines 6-25; column 42, lines 28-38; column 57, lines 20-60).

35. Luyster discloses combining first and second linear functions to produce a nonlinear block substitution table, or s-box, as evident by at least the Abstract.

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36. Luyster discloses the claimed invention except for the use of linear orthomorphisms, thereby failing to set a maximal nonlinear block substitution tables based on the combination of the linear orthomorphisms. Mittenthal discloses using nonlinear orthomorphisms to create maximal nonlinear block substitution tables. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use linear orthomorphic functions to generate a nonlinear block substitution table as taught by Mittenthal, since Mittenthal discloses at column 2, lines 39-43 that such a modification would make cryptanalysis more difficult. Furthermore, Mittenthal discloses in column 19, lines 26-32 that generating nonlinear orthomorphisms involves routine skill in the art.

37. Chapter 2144.05 of the MPEP states that optimizing an algorithm will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such optimization is critical. See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Therefore, deterministically generating maximal nonlinear block substitution tables is not patentable as there have been disclosures of using linear orthomorphisms to create nonlinear block substitution tables. In addition there has been no evidence provided that such an optimization is critical or produces unexpected results. See also MPEP § 2131.03.

38. Regarding claims 17 and 19, Luyster teaches wherein the second generating function is a complement of the first generating function (column 39, lines 17-28). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the second function be a complement of the first function. It merely be a fact of reversing parts to ensure

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different keys between the two halves. See MPEP § 2144.04. See also *In re Gazda*, 219 F.2d 449, 452, 104 USPQ 400, 402 (CCPA 1955).

39. As per claim 18, Luyster teaches a computer-implemented method for deterministically generating maximal nonlinear block substitution tables from binary data, comprising:

selecting a first set of a plurality of complete linearly independent numbers from the binary data (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28);

selecting a second set of a plurality of complete linearly independent numbers from the binary data (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28).

40. Luyster does not teach recursively applying a first generating function to the first set of linearly independent numbers to create a major cycle of a first orthomorphism; generating a plurality of cycles of the first orthomorphism; recursively applying a second generating function to the second set of linearly independent numbers to create a major cycle of a second orthomorphism; generating a plurality of cycles of the second orthomorphism; and setting the maximal nonlinear substitution tables by combining the linear orthomorphisms, the substitution tables for use in encrypting clear text messages which are in the form of an ordering of binary numbers.

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41. Luyster discloses the claimed invention except for the use of linear orthomorphisms, thereby failing to set a maximal nonlinear block substitution tables based on the combination of the linear orthomorphisms. Mittenthal discloses using nonlinear orthomorphisms to create maximal nonlinear block substitution tables. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use linear orthomorphic functions to generate a nonlinear block substitution table as taught by Mittenthal, since Mittenthal discloses at column 2, lines 39-43 that such a modification would make cryptanalysis more difficult. Furthermore, Mittenthal discloses in column 19, lines 26-32 that generating nonlinear orthomorphisms involves routine skill in the art.

42. Chapter 2144.05 of the MPEP states that optimizing an algorithm will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such optimization is critical. See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Therefore, deterministically generating maximal nonlinear block substitution tables is not patentable as there have been disclosures of using linear orthomorphisms to create nonlinear block substitution tables. In addition there has been no evidence provided that such an optimization is critical or produces unexpected results. See also MPEP § 2131.03.

43. As per claims 20, 21 and 22, Luyster teaches a system, comprising:
a communications link (column 56, line 60 to column 57, line 12);
a first computer in communication with the communications link (column 56, line 60 to column 57, line 12); and

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a second computer in communications with the communications link (column 56, line 60 to column 57, line 12), the second computer having an ordered read set of data and instructions stored thereon which, when executed by the second computer cause the second computer to perform the steps of:

selecting a first generating function (Figures 1 [blocks k1, k2], 2 [block key1, key 2], 5 [blocks 92, 100g], 11; column 38, lines 24-36; column 51, lines 19-67);

selecting a second generating function (Figures 5 [blocks 94, 100h], 11; column 38, lines 24-36; column 51, lines 19-67);

selecting first and second sets of complete linearly independent numbers (Figures 1 [blocks 12, 14], 2 [blocks 16, 18], 3 [blocks 52, 54], 4 [blocks 52, 56], 6 [blocks 112, 114], 7 [blocks 152, 154], 8 [block 152, 154], 9 [blocks 192, 194], 14 [blocks 302, 304]; column 11, lines 42-49; column 18, lines 54-67; column 42, lines 22-28);

calculating first and second linear functions from the generating functions and the sets of linearly independent numbers (Figure 1 [blocks 16, 18], 3 [blocks 84, 86], 6 [blocks 144, 146], 7 [blocks 184, 186], 9 [block 226, 228], 14 [blocks 342, 344]; column 22, lines 6-25; column 42, lines 28-38; column 57, lines 20-60).

44. Luyster discloses combining first and second linear functions to produce a nonlinear block substitution table, or s-box, as evident by at least the Abstract.

45. Luyster discloses the claimed invention except for the use of linear orthomorphisms, thereby failing to create maximal nonlinear block substitution tables by combining the linear orthomorphisms. Mittenthal discloses using nonlinear orthomorphisms to create maximal nonlinear block substitution tables. It would have been obvious to one having ordinary skill in

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the art at the time the invention was made to use linear orthomorphic functions to generate a nonlinear block substitution table as taught by Mittenthal, since Mittenthal discloses at column 2, lines 39-43 that such a modification would make cryptanalysis more difficult. Furthermore, Mittenthal discloses in column 19, lines 26-32 that generating nonlinear orthomorphisms involves routine skill in the art.

46. Chapter 2144.05 of the MPEP states that optimizing an algorithm will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such optimization is critical. See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Therefore, deterministically generating maximal nonlinear block substitution tables is not patentable as there have been disclosures of using linear orthomorphisms to create nonlinear block substitution tables. In addition there has been no evidence provided that such an optimization is critical or produces unexpected results. See also MPEP § 2131.03.

Conclusion

47. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

48. The following patents are cited to further show the state of the art with respect to optimizing block substitution tables, such as:

United States Patent No. 6,075,865 to Scheidt et al., which is cited to show maximizing the non-linear of a block substitution table to make it more robust against differential cryptanalysis techniques (column 9, line 47 to column 10, line 23).

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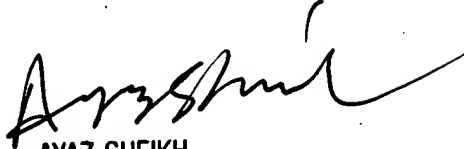
United States Patent Application Publication No. 2001/0019610 to Shimoyama, which is cited to show an optimization processing unit optimizes an input and output bit number of an S-box based on parameters inputted from an input unit.

49. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian La Forgia whose telephone number is (571) 272-3792. The examiner can normally be reached on Monday thru Thursday 7-5.

50. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (571) 272-3795. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

51. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Christian LaForgia
Patent Examiner
Art Unit 2131
Clf


AYAZ SHEIKH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100